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TITLE: Dynamic lookup service in distributed system

Brief Summary Text (28):

Conventional lookup services are static: whenever updates to the lookup service are needed to either add a new service or delete an existing service, the lookup service is taken offline, rendering the lookup service inaccessible, and then, the lookup service is manually updated by the system administrator. During the time when the lookup service is offline, clients in the distributed system are unable to access the lookup service and any of its network services. Another limitation of conventional lookup services is that, when updated, clients are not made aware of the updates to the lookup service until they explicitly perform a refresh operation, which downloads the latest service information to the clients. Before such a refresh, however, if a client requests a service that is no longer available, an error occurs which may cause the client to hang. Also, before a refresh, the client is not aware of any new services that have been recently added to the lookup service. It is therefore desirable to improve lookup services for distributed systems.

Brief Summary Text (33):

In accordance with methods consistent with the present invention, a method is provided in a data processing system having a lookup service with associated services and a client lookup manager with an associated cache. This method transmits an event by the lookup service that identifies a change to one of the associated network services. The client lookup manager receives the event and updates the associated cache to reflect the change.

Brief Summary Text (34):

In accordance with methods consistent with the present invention, a method is provided in a data processing system having a client and lookup service with associated services. This method receives a request from a client for access to a network service, then retrieves a reference from a cache reflecting a particular network service corresponding to the requested network service and transmits the reference to the client.

Detailed Description Text (57):

Once the cache is populated, the client lookup manager handles all activities related to the cache including accessing, updating and deleting the cache. For example, as shown in FIG. 11, when the client desires access to a service reference, it transmits a request, via a local event to the client lookup manager (step 1100). In step 1110, the client lookup manager searches the cache to determine whether an instance of the requested service is stored in the cache. If the service is found (step 1120), the client lookup manager returns an instance of the requested service in step 1130 and the process ends. If, the service is not found, the client lookup manager returns a null reference in step 1140, and the process terminates. Depending on the specific implementation of the client lookup manager, the process can either re-institute a new search, wait for a new query request from the client, or re-query the associated lookup services.

Detailed Description Text (61):

Just as the client may request that it be notified of state changes in network services occurring within each lookup service, as previously described in FIG. 4, so too can the cache request that it be notified. In other words, the client and the cache can separately be notified of the same or different events after receiving notification from a lookup service. FIG. 13 shows the steps performed by the client lookup manager when either the cache or the client has requested event notification. First, as shown in step 1310, the lookup service observes a state change in a registered service. Next,

the lookup service determines, in step 1320, whether the event satisfies matching criteria specified by one of its associated clients. If it does, the lookup service transmits the event notification to the requesting client (step 1330) via a remote event. If the event does not satisfy matching criteria, the process ends. Next, the cache (step 1350) determines whether the reported event necessitates a cache update. More specifically, since the cache may receive multiple events corresponding to the same service, it must first determine whether it has previously been notified of this particular event. For example, a particular service may be registered with more than one lookup service or multiple configurations of the same service can be registered with a lookup service. When a lookup service reports an event to a client, the lookup service has no way of knowing whether the event has previously been reported to the client via another lookup service. If the cache has not previously been notified of this event, the cache is updated in step 1360. Otherwise, the process ends (note: if the cache has been previously notified, then the client has also previously been notified). Once the cache has been updated, it next determines whether the client is required to be notified as well (step 1370). If the client requested notification, a notification message is sent via local event to the client in step 1380 and the process terminates. This "many-to-one" relationship between the events received by the cache 815 and the events sent by the cache hides from the client 812, the lookup services with which the cache 815 interacts. For many entities that use the cache's event mechanism to interact with the cache's discovered services, knowledge of the number of distinct service references, as well as identification of the lookup services with which those references are registered, is of no interest. Such entities typically are interested only in acquiring a reference--not all references to the services it needs to do its job. For entities which are interested in this additional information, the cache 815 provides methods separate from the event mechanism for obtaining that information.

Current US Cross Reference Classification (1):

707/2

Other Reference Publication (5):

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Other Reference Publication (14):

Conhaim, "Online shopping: a beginner's guide; includes related listing of videotex services," Link-Up, vol. 5, No. 6, p. 32, Nov. 1988.

Other Reference Publication (21):

Gardner, "Kodak Follows Startup Into Online Photo Processing Business," Internet World, Sep. 8, 1997, pp. 5-6.

Other Reference Publication (26):

KODAK PHOTONET FAQ, PhotoNet Online, Jun. 14, 2002, pp. 1-3.

Other Reference Publication (27):

Kramer, "NETWATCH; The AJC's Daily Online Guide; Get the picture: Kodak will send photos to Web," The Atlanta Journal and Constitution, Sec. Features, p. 08C, Jun. 5, 1997.

Other Reference Publication (31):

LightSurf Instant Imaging--Press Release, "Kodak And LightSurf Collaborate On Kodak Picture Center Online," LifeSurf Technologies Inc., Jun. 14, 2002, pp. 1-3.

Other Reference Publication (33):

McEnaney, "Point-and-Click Memory Sharing; Launches PhotoNet online digital photography and imaging services," Photographic Trade News, Sec. p. 23, Jan. 1997.

Other Reference Publication (50):

Trommer, "Thomas Unveils Online Purchasing Network--Eases Product Sourcing And Ordering Through EDI," Electronic Buyers' News at 60, Dec. 11, 1995.

Other Reference Publication (86):

Proudfoot, "Replects: Data Replication in the Eden System," Department of Computer Science, University of Washington, Technical Report No. TR-85-12-04, Dec. 1985, pp. 1-156.

Other Reference Publication (176):

Venners, B., "Jini Technology, Out of the Box", JAVAWORLD, 'Online!' pp 1-4, Dec. 1998.

CLAIMS:

1. A method in a distributed system having a lookup service with associated network services and a client lookup manager with an associated cache, the method comprising the steps of: sending a request by the client lookup manager to the lookup service identifying one of the associated network services to be accessed; receiving said request by the lookup service; transmitting an object by the lookup service, wherein the object provides a service reference to one of the associated network services; receiving said object by the client lookup manager internal to a client; and storing the service reference in the associated cache.
2. The method of claim 1 further comprising transmitting at least one service reference by the client lookup manager to a client associated with the client lookup manager.
3. The method of claim 1 wherein the lookup service transmits a null reference to the client lookup manager.
4. The method of claim 3 wherein the client lookup manager transmits a null reference to a client associated with the client lookup manager.
5. The method of claim 1 wherein the client lookup manager repeatedly transmits requests to the lookup service for a predetermined period of time until a specific network service of interest is found.
8. The method of claim 5 wherein the client lookup manager repeatedly transmits requests to the lookup service until a predetermined number of network services of interest are found.
9. A distributed system having a client, a client lookup manager with an associated cache, and at least one lookup service containing service references for accessing associated network services, the distributed system comprising: means for transmitting a request by the client lookup manager to at least a first lookup service identifying at least one of the associated network services to be accessed; means for receiving the request by the lookup service; means for transmitting an object by the lookup service, wherein the object provides a service reference to at least one network service of interest; means for receiving said object by the client lookup manager internal to a client; and means for storing the service reference by the client lookup manager in the associated cache.